UNIVERSITI PUTRA MALAYSIA

INJURY CHARACTERISTICS OF MOTORCYCLISTS INVOLVED IN MOTORCYCLE CRASHES IN KLANG VALLEY, MALAYSIA

PANG TOH YEN

INJURY CHARACTERISTICS OF MOTORCYCLISTS INVOLVED IN MOTORCYCLE CRASHES IN KLANG VALLEY, MALAYSIA

By

PANG TOH YEN

Thesis Submitted in Fulfilment of the Requirements for the Degree of
Master of Science in the Faculty of Engineering
Universiti Putra Malaysia

February 2000

Dedicated to my beloved family:

Dad, Mum,

Brother, Sister-in-law, Sister

and Grandmother

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science.

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Chairman : Radin Umar Radin Sohadi, Ph.D.

Faculty : Engineering

The objectives of this study were to establish the relationship between injury outcomes and i) riders' characteristics, ii) their exposure and iii) the motorcycle factors resulting from serious and fatal motorcycle crashes. Data on motorcycle crashes and injuries from January to December 1998 were obtained from two sources, namely the police reports and hospital records. These linked data were then used to examine the injury patterns sustained by the motorcyclists involved in motorcycle crashes in Malaysia. In order to assess the independent variables in influencing the injury outcome, the logistic regression method was used to determine the odds ratios and the multivariate models for the injured motorcyclists.

In the statistical analysis, a total of five independent variables were found to significantly ($p<0.05$) influence the fatality risk. Those variables were (i)age of motorcyclists, (ii) engine capacity of the motorcycles, (iii) objects struck,

(iv) type of collisions and (v) location sites. Results showed that fatality risks were likely to associate with older motorcyclists, larger engine motorcycles, collision with a heavy commercial vehicle, head-on collision, and non–junction sites.

The study also revealed that the most frequent injuries to fatally injured motorcyclists were head injuries (56.5%) and chest injuries (27.4%). Injuries to the lower limbs, however, accounted for the highest proportion (54.4%) for the serious injury cases investigated. This is followed by the upper limb injuries (19.9%). Most motorcyclists were detained for one or two nights for observation and recovery. The mean stay for all patients were about 5 days. However, those motorcyclists who suffered from lower limb injuries often required longer stay in hospital.

In addition, the study indicated that side collisions presented a difficult problem in crash protection towards the lower limbs. Despite the fact that most motorcycles in Malaysia had very little crushable and protective structure around the rider's lower limb region. Whereas, this kind of protection was found to reduce the risk of lower limb injures in many studies. As such, further investigation on the design of effective leg protector for motorcyclists should be carried out.

Abstrak thesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

SIFAT-SIFAT KECEDERAAN PENUNGGANG MOTOSIKAL AKIBAT KECELAKAAN MOTOSIKAL DI LEMBAH KLANG, MALAYSIA

Oleh

PANG TOH YEN

Februari 2000

Pengerusi : Radin Umar Radin Sohadi, Ph.D.

Fakulti : Kejuruteraan

Objektif kajian ini adalah untuk membentuk perhubungan antara (i) individu, (ii) pendedahan trafik dan (iii) faktor-faktor kenderaan dengan tahap kecederaan akibat daripada kecelakaan parah dan maut yang melibatkan pengguna motosikal di Malaysia. Data kecelakaan jalan raya dan kecederaan yang melibatkan motosikal daripada Januari hingga Disember 1998 telah diperolehi daripada dua sumber utama iaitu laporan polis dan rekod hospital. Laporan polis dan data hospital tersebut telah dikait dan digunakan untuk memeriksa corak kecederaan dan faktor penyumbangan kepada kecederaan penunggang motosikal di Malaysia. Untuk menilai pembolehubah-pembolehubah yang mempengaruhi tahap kecederaan, kaedah regresi logistik telah digunakan untuk menentukan nisbah kebarangkalian dan membentuk model multivarite.

Daripada analisa statistik, didapati terdapat sebanyak lima pembolehubah bererti ($p<0.05$) yang mempengaruhi tahap kecederaan. Antara pembolehubah tersebut ialah (i) umur penunggang (ii) saiz enjin motosikal, (iii) objek perlanggaran, (iv) jenis perlanggaran dan (v) tempat kejadian. Keputusan menunjukkan risiko kematian adalah tinggi pada golongan yang lebih tua, mereka yang menunggang motosikal yang berkuasa tinggi, berlanggar dengan kenderaan komersil, perlanggaran depan dengan depan, dan perlanggaran yang berlaku di jalan lurus tanpa simpang.

Daripada kajian yang dilakukan, didapati juga kecederaan utama yang dialami oleh mangsa yang meninggal dunia akibat kecelakaan jalan raya adalah pada bahagian kepala (56.5%). Ini diikuti dengan kecederaan pada bahagian dada (27.4%). Walau bagaimanapun, kecederaan pada anggota kaki adalah yang paling tinggi (54.4%) bagi kecederaan parah. Ini diikuti pula dengan kecederaan pada anggota tangan (19.9%). Kebanyakan penunggang motosikal dikehendaki tinggal dalam wad selama satu atau dua hari untuk pemerhatian dan penyembuhan. Purata hari tinggal dalam hospital bagi semua pesakit akibat daripada kecelakaan adalah 5 hari. Golongan penunggang motosikal yang menerima kecederaan pada bahagian anggota kaki bagaimanapun dikehendaki untuk tinggal lebih lama dalam hospital.

Selain itu, kajian ini menunjukkan bahawa perlanggaran sisi menimbulkan masalah yang rumit dalam perlindungan kecederaan pada bahagian kaki. Ini

adalah kerana kebanyakan motosikal di Malaysia mempunyai hanya sedikit struktur kebolehlanggaran dan perlindungan pada bahagian kaki penunggang. Pada hal struktur kebolehlangaran dan perlindungan ini telahpun dilaporkan boleh mengurangkan risiko kecederaan pada bahagian kaki dalam banyak kajian yang lepas. Oleh yang demikian, kajian lanjutan ke atas keberkesanan rekabentuk alat perlindungan kaki untuk para penunggang perlu diadakan.

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Last but not least, may my family be blessed with good health, long life and happiness for all the love and care they have given me all this while. Thanks also for always having faith in me.

I certify that an Examination Committee met on 1st February, 2000 to conduct the final examination of Pang Toh Yen on his Master of Science thesis entitled "Injury Characteristics of Motorcyclists Involved in Motorcycle Crashes in Klang Valley, Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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Date: 10 MAR 2000

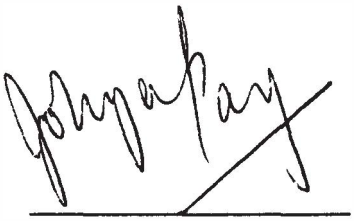
This thesis was submitted to the Senate of Universiti Putra Malaysia and was accepted as fulfilment of the requirements for the degree of Master of Science.

KAMIS AWANG, Ph.D.
Associate Professor,
Dean of Graduate School,
Universiti Putra Malaysia.

Date: 11 MAY 2000

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



(PANG TOH YEN)

Date: 10/3/2000

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95% CI	95% Confidence Interval
AIS	Abbreviated Injury Scale
CT	Computed Tomographic
HCVs	Heavy Commercial Vehicles
HKL	Hospital Kuala Lumpur
HUKM	Hospital Universiti Kebangsaan Malaysia
ISS	Injury Severity Score
LCVs	Light Commercial Vehicles
MAIS	Maximum Abbreviated Injury Scale
OR	Odds Ratios
PC	Personal Computer
PDRM	Royal Malaysia Police
RSRC	Road Safety Research Centre
SPSS	Statistical Package for Social Science
UPM	Universiti Putra Malaysia

CHAPTER I

INTRODUCTION

This thesis describes a study on motorcycle crashes and injury characteristics of motorcyclists within the context of Malaysia. The overall objective of this study was to obtain a complete picture on the circumstances of motorcycle crashes, and also to identify the injury causes. In order to make any mode of transport safe, it is necessary to understand how accidents occurred, the causes of injuries, and the nature of contact during the crash. Then it may be possible to take some effective remedial actions to reduce the likelihood of crashes and to minimise the severity of injuries on motorcyclists during an accident.

Initially, this chapter considers the background of the study which includes the overall registered motorcycles in Malaysia. It then describes motorcycle crashes and injury rates in Malaysia, leading to the identification of the magnitude and seriousness of the motorcycle safety problem.

Background of the Study

The motorcycle is a major mode of personal transport in Malaysia, because it is relatively affordable and 'reliable' compared to other motor vehicles. As such, about 53% of the registered vehicles in this country are motorcycles. In addition, for the last decade or so, the number of registered motorised two-wheelers (motorcycles and scooters) increased tremendously from 830,834 in 1976 to 4,328,997 in 1997 (Figure 1.1). Consequently, motorcycle crashes also increased dramatically during that period from 18,187 in 1978 to 80,100 in 1997. Likewise, the annual motorcycle fatalities rose in the same period from less than 400 in 1976 to 3,760 in 1997 (PDRM 1993, 1997).

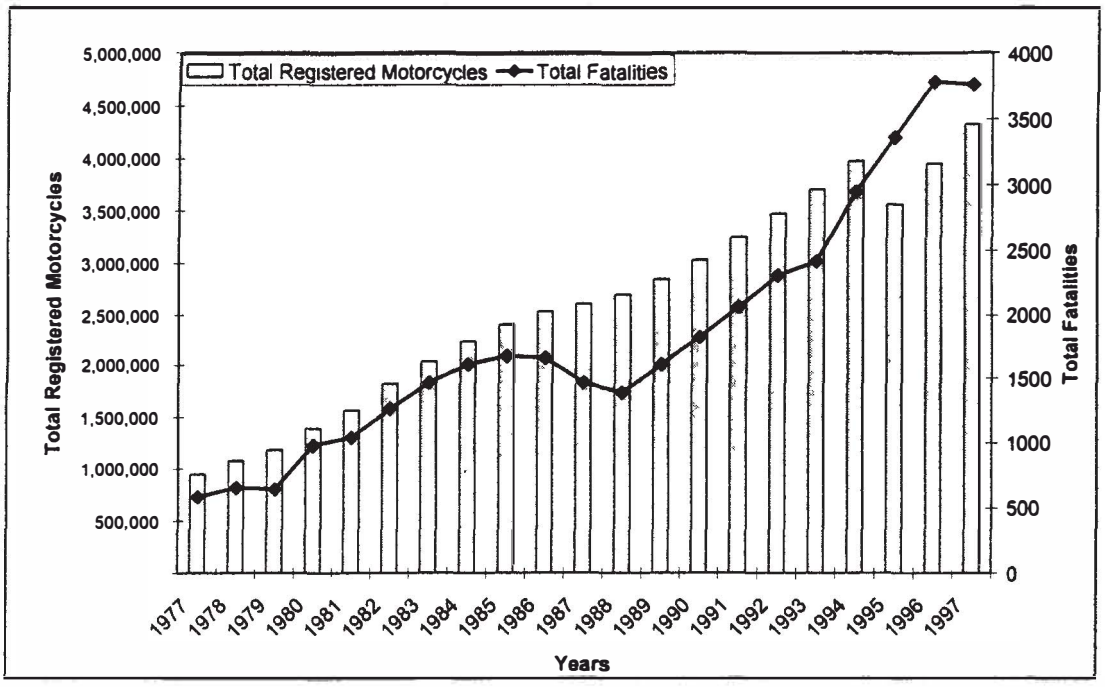

Figure 1.1: Total Number of Registered Motorcycles and Total Number of Fatally Injured Motorcyclists in Road Crashes.
(Source: Royal Malaysia Police (PDRM) 1993, 1997)

The increased popularity of motorcycles and the concurrent rise in motorcycle crashes had led to the recognition that the motorcycle was associated with higher risk of death or injury than any other forms of transportation. In Malaysia, it is reported that the overall relative risk is about 20 times greater for motorcycles than passenger cars (Radin et al. 1995). Likewise, it can be seen that the average annual increase in motorcycle fatalities is greater than that of car (Figure 1.2). This increase, however, should be seen against the increased motorcycle ownership in the country (Figure 1.1). Therefore, it is not surprising that motorcycle riders and the pillions constituted almost 60%, an alarmingly high percentage of death in road traffic crash in 1997.

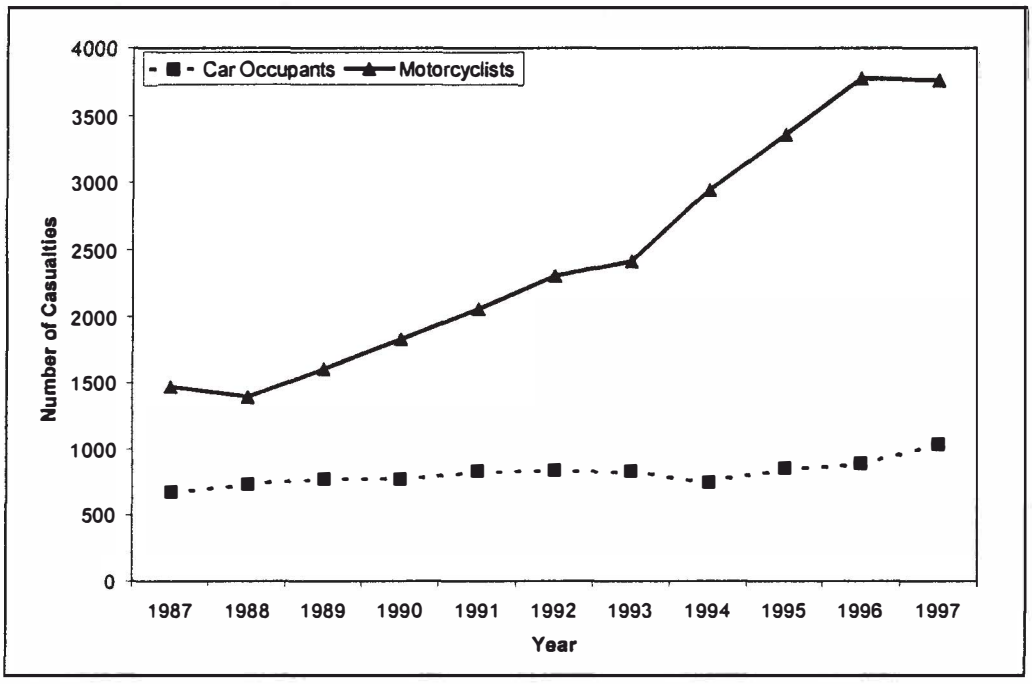

Figure 1.2: Number of Deaths for Car and Motorcycle Road Users
(Source: Royal Malaysia Police (PDRM) 1997)